

WAYNE KERL





BRIDGE SOURCES
AND DETECTORS
S161 - S261 - R161 - R261
Instruction Manual

The Wayne Kerr Company Limited,
Sycamore Grove,
New Malden,
Surrey.

Telephone: MALden 2202
Cables: WAYNKERR, New Malden
Telex: 262333

Wayne Kerr Corporation,
22 Frink Street,
Montclair,
New Jersey, U. S. A.

Telephone: (201)746-2438
Cables: WAYNKERR,
Montclair, New Jersey.

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BRIDGE SOURCES S161 & S261

General

These Sources, with their associated Detectors, are intended for use with the Wayne Kerr Admittance Bridges and cover the frequency range 5Mc/s to 250Mc/s. The table below shows the appropriate combination.

Frequency Range	Bridge	Source	Detector
5-100Mc/s	B801(B)	S161(B)	R161
50-250Mc/s	B901	S261	R261

Each source has a self-contained power supply operating from 115V or 230V A. C. 40-60c/s mains. Connection to the bridge is made by a cable terminated at each end by a miniature coaxial plug. A suitable plug is supplied.

The source is contained in a steel case, 8.75" by 3" front to back by 7" deep. The weight is approximately 13lb.

Performance Specification

Each source is fitted with a three-position range switch:

S161(B)	S261
Range 1: 5-13Mc/s	50 - 84Mc/s
Range 2: 13-35Mc/s	80 - 145Mc/s
Range 3: 35-100Mc/s	140 - 250Mc/s

The range in use is indicated by the lighting of a pilot lamp at the end of the scale, the lamp switching being coupled to the range selector switch.

The accuracy of scale calibration is 1 per cent. The source, in conjunction with its detector, gives adequate discrimination when connected to the appropriate bridge: 0.1 mmho for the B901 and 0.025 mmho for the B801(B).

The output from the source is amplitude-modulated at 1kc/s (nominal) and is at a level of approximately 1 volt r. m. s.

The S161B has an output amplitude control.

Circuit Details

Power Supply

Both types of source are supplied from the mains rectifier circuit shown in Fig. 1. The mains input is through a 3-pin connector at the rear of the case. This connector is illustrated in Fig. 1 (top left) and the connections are as follows:

- A Live line
- B Neutral line
- C Earth pin

The input passes through an encapsulated filter (shown within the dotted rectangle) to the fuse and switch.

The primary winding of the mains transformer is tapped for 110-115, 190-220 and 220-250 volts, 40-60c/s. Access to the plug for these tapings can be obtained by removing the top of the case. The fuse fitted is normally 500mA but should be changed to 1A for 110V operation.

The H. T. rectifier circuit is of the conventional type, using a 6X4 full-wave rectifier and resistance - capacitance smoothing.

The nominal value of the smoothed h. t. is 300 volts but different loadings by the sources or detectors results in the exact value lying above or below this figure.

Oscillator Circuit

The main oscillator is of the Colpitts type, using one half of a 12AT7 double triode V_{3a} (Fig. 2). The main tuning coils L_3 , L_4 and L_5 together with the tuning capacitor C_{16} are enclosed in a screening box. The tuning coil in use is selected by the range switch (SWA4 rear and SWA3 rear). Adjacent coils are short-circuited (by SWA4 front and SWA3 front) to prevent unwanted resonance. Wafer SWA2 front is used to select the appropriate coupling coil (L_6 , L_7 or L_8), the degree of coupling being pre-set for each range to give the required output. Other sections of the switch short-circuit the coupling coils not in use (SWA2 rear) and control the appropriate pilot lamp (SWA1 front).

Modulator Circuit

The modulator valve V_2 drives an r-c oscillator circuit C_{10} - C_{12} , R_7 - R_9 , which provides a sinusoidal signal at a frequency of approximately

1kc/s. This is applied to the grid of the main oscillator through C_{13} , R_{10} and R_{11} . The modulator valve is an EF. 91.

The circuits of sources S161 and S261 are similar, with the exception of the coil constants in the tuning circuits and the tuning capacitors C_{16a} and C_{16b} . In the Source S161, C_{16} is 230pF maximum, and in S261 it is 50pF maximum.

Operating Instructions

Connecting-up

Check that the flexible lead to the mains plug is wired according to the tabulation given on page 2. It is important that a good earth connection is provided.

Connect the source to the bridge, and the bridge to the detector, by means of a coaxial cable: suitable mating components are supplied.

Switch on and select the required range on the frequency dial.

Instructions for tuning the detector will be found on page 7. In the event of the pilot lamps not lighting, first check that the mains supply is on and if the instrument remains inoperative, disconnect it from the supply and examine the mains input fuse.

Maintenance

It is recommended that the tuned circuits should not be adjusted by the user. If the calibration becomes inaccurate the instrument should be returned to the factory.

Valve Replacement

To obtain access to the valves, loosen the single captive screw at the back of the case, remove the lid, loosen the captive screws beneath the case and withdraw the chassis.

The rectifier valve (6X4) will be found immediately behind the mains transformer. The oscillator and modulator valves are inside the screened compartment, the cover of which can be removed by taking out the four retaining screws at the back of the compartment.

Pilot Lamps

The three pilot lamps are held on a bracket secured to the main framework by a hexagon-headed screw which will be seen near the left-hand lamp. On withdrawing this screw the lamp bracket can be lifted clear of the light shield and the lamps are easily accessible.

The rating of the lamps is 6.5V 0.3A.

Fuse

This is mounted internally on the frame behind the mains input plug. The instrument must be disconnected from the mains supply before the chassis is removed. The fuse is a standard cartridge type rated at 500mA for 190-250V supplies. It should be 1A for 110V supplies.

BRIDGE DETECTORS R161 & R261

General

These detectors have been designed to operate in conjunction with the signal sources and bridges specified on page 1. The R161 covers the frequency range 5Mc/s to 100Mc/s, and the R261 covers 50Mc/s to 250Mc/s.

Each detector has a self-contained power supply which can be operated from 110-115 or 190-250V supplies, 40-60c/s. Connection to the Bridge is made by means of a coaxial cable terminated in miniature coaxial plugs.

The detector is contained in a steel case 8.75" by 8" front to back by 7" deep. The weight is 11lb.

Performance Specification

Each detector is fitted with a three-position range switch.

R161	R261
Range 1: 5 - 13Mc/s	50 - 84Mc/s
Range 2: 13 - 35Mc/s	84 - 145Mc/s
Range 3: 35 - 100Mc/s	145 - 250Mc/s

The range in use is indicated by the lighting of a pilot lamp at the end of the scale, the lamp switching being coupled to the range selecting switch.

A logarithmic gain control is mounted on the front panel. On detector R161 this control forms part of the i. f. amplifier chain. On R261 the control operates on the a. f. amplifier.

The audio frequency output is taken from a phone jack on the front panel. Headphones of 2000 ohms resistance should be used or, if visual indication is preferred, a sensitive milliwattmeter or valve voltmeter may be connected to the jack.

The receivers are sensitive over the greater part of their range to $5\mu\text{V}$ for unity signal/noise ratio. The highest range of the R261 (145-250Mc/s) has a lower sensitivity (10-15 μV) but the output from the source has been increased to compensate for this reduction.

R161 Circuit Details

Refer to the circuit diagram (Fig. 3). The signal from the bridge is injected into the cathode of a grounded-grid amplifier V_{2a} ($1/2$ 12AX7). The anode circuit is tuned by the coils L_{10} , L_3 and L_4 , and by C_{11a} , and the tuned signal is fed to the mixer, a triode connected as a diode, by the small capacitor C_{12} .

A portion of the twin triode V_{3b} forms the local oscillator, a Colpitts tuned circuit containing L_5 C_{15} , L_6 C_{16} L_7 C_{17} and variable tuning provided by C_{11b} and c . The output from this oscillator is fed to the diode-connected mixer by coupling which includes the capacitance of the valve bases (C , shown dotted).

The output of the mixer is fed to the four-stage intermediate-frequency amplifier tuned to 150kc/s. The gain control (R_{15}) precedes the second stage. The second detector (V_6) is a germanium rectifier and this is followed by an audio-frequency stage V_{5b} ($1/2$ 12AT7).

R261 Circuit Details

Refer to the circuit diagram (Fig. 4). The signal from the Bridge is injected into the cathode of a grounded-grid amplifier V_{2b} (triode section, 6U8). The anode load of this stage is also the tuned circuit for the local oscillator. This is a Colpitt's circuit, using V_{1b} . The grounded-grid amplifier (V_{2b}) prevents the oscillator radiating.

The combined signals (from the grounded-grid amplifier and the local oscillator) are fed to the mixer stage (V_{2a}). The anode circuit of this stage is tuned to the intermediate frequency employed in the R261, which is centred on 1.6 Mc/s.

The intermediate-frequency signal is coupled from the mixer to the i. f. amplifier stage (V_{3a}). The signal is detected by MR_1 and the resultant modulation fed to the a. f. amplifier (V_4 and V_{3b}). The sensitivity control (RV_1) is a potentiometer connected between the two stages of the a. f. amplifier. The output from V_{3b} is applied to the phones jack.

Operating Instructions

The bridge detectors are connected to the a. c. mains supply in the same manner as the sources (see page 2).

Connect the source and detector to the bridge, using coaxial cables.

When the source has been set to the required measurement frequency, adjust the receiver sensitivity control to its approximate mid-position and tune the receiver for maximum volume in the 'phones. The bridge can now be balanced in the usual manner, the receiver sensitivity being increased as necessary. As the balance point is approached, there is a tendency for the Bridge to 'pull' the source frequency, and this pulling may be sufficient to give a false indication of balance due to loss of signal. To overcome this, always re-tune the SOURCE when approaching balance.

Care must be taken, particularly with R161, to avoid too high a setting of the Gain Control. This could cause overloading and make the location of the true balance point difficult.

R161 Maintenance

The information on page 3 , relating to the Sources, applies also to the R161 detector although any calibration inaccuracy is not so important.

A. F. Gain - Connect a 4-k Ω resistor across the phones output jack. Apply a 1-kc/s signal to grid V5b and adjust to 130mV (r. m. s.). The output (across the 4-k Ω resistor) should be not less than 1V (r. m. s.).

I. F. Gain - Load the phones jack as above and turn the Gain Control fully clockwise. Apply a 150-kc/s signal, 30 per cent modulated at 1kc/s, to grid V4a and adjust to 60 μ V. The output (at the jack) should be not less than 1V (r. m. s.).

Transfer the input to grid V2b and adjust to 10 μ V. The output should again be not less than 1V.

Overall Sensitivity - An input signal of 5-15 μ V, from 5 to 100Mc/s, should provide unity signal-to-noise ratio as observed on an oscilloscope.

I. F. Bandwidths - The intermediate frequency is centred on 150kc/s and the bandwidth (-6dB) is approximately 60kc/s.

R261 Maintenance

The information on page 3 , relating to the Sources, applies also to the R261 detector although any calibration inaccuracy is not so important.

A. F. Gain - Connect a 4-k Ω resistor across the phones output jack. Turn the Gain control fully clockwise. Apply a 1-kc/s signal to grid V4 and adjust to 8mV (r. m. s.). The output (across the 4-k Ω resistor) should be not less than 1V (r. m. s.).

I. F. Gain - Load the phones jack as above and ensure that the Gain control is fully clockwise. Apply a 1.6Mc/s signal, 30 per cent modulated at 1kc/s , to grid V2a and adjust to $30\mu\text{V}$. The output (at the jack) should be not less than 1V (r. m. s.).

Overall Sensitivity - An input signal of $10\text{-}30\mu\text{V}$, from 50 to 250Mc/s , should provide unity signal-to-noise ratio as observed on an oscilloscope.

I. F. Bandwidth - The intermediate frequency is centred on 1.6Mc/s and the bandwidth (-6dB) is approximately 140kc/s .

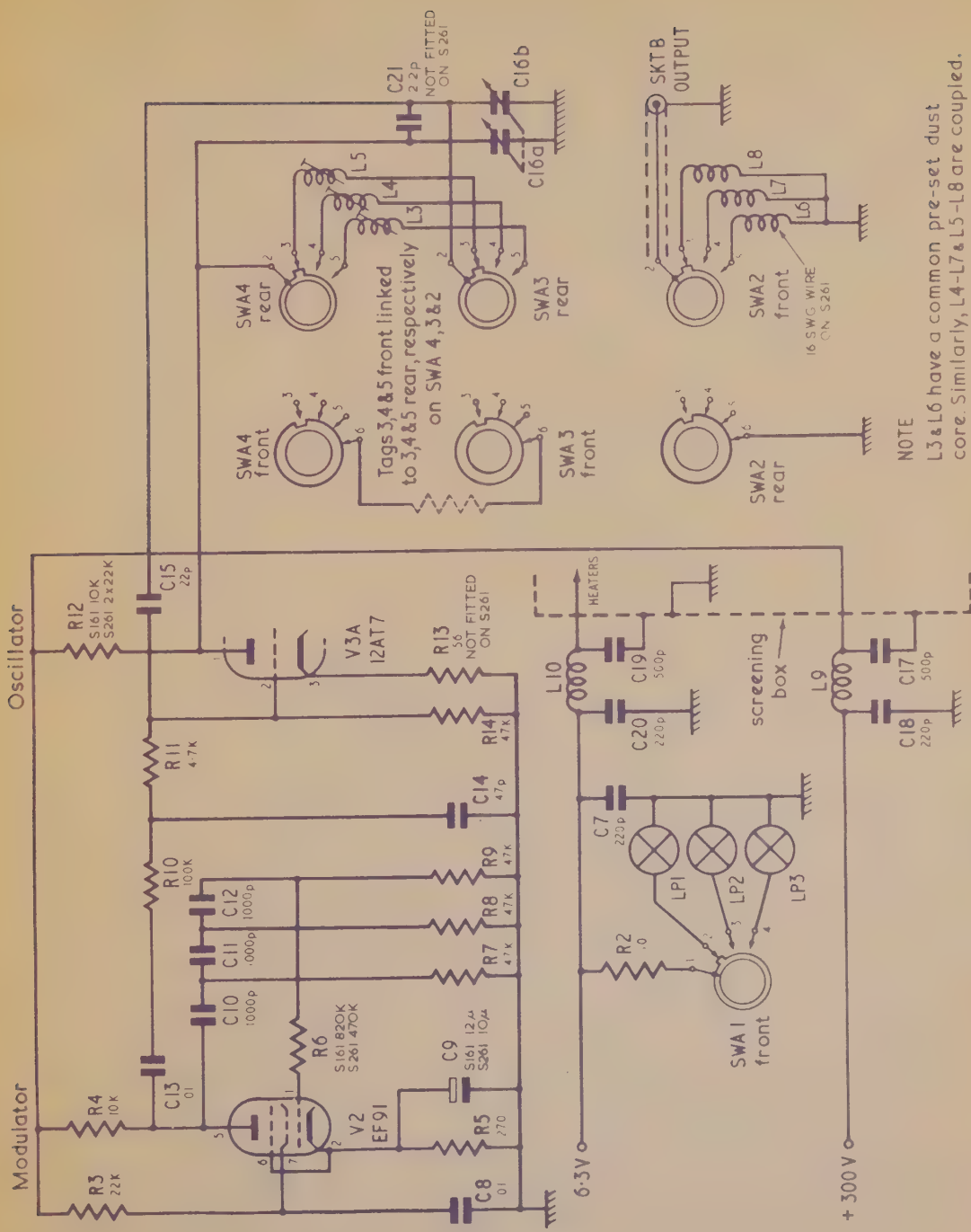


FIG.2 CIRCUIT OF BRIDGE SOURCES TYPE S161 & S.261
(DRGS. 2243/O & WP3701/E)

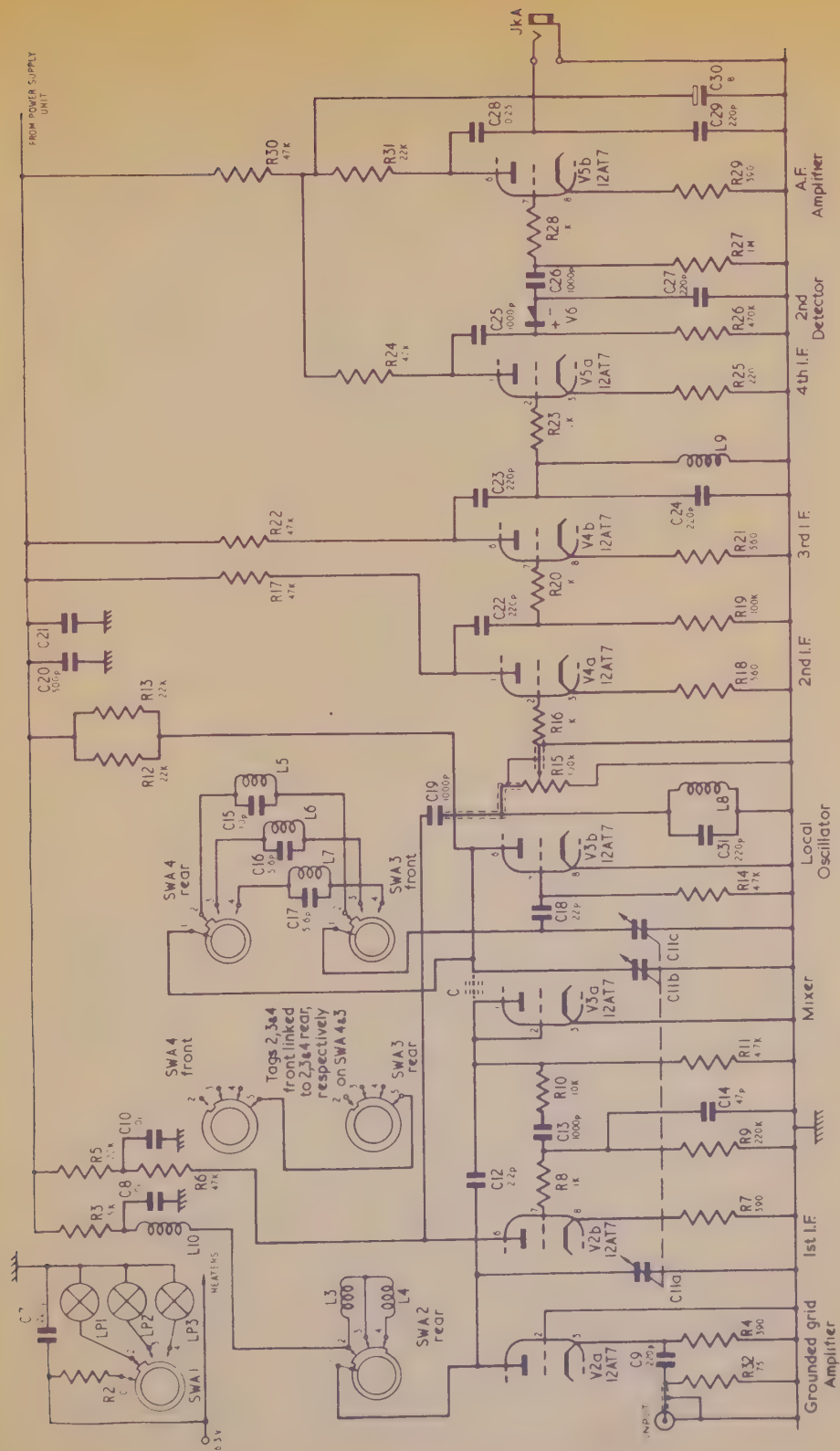


FIG. 3. CIRCUIT OF BRIDGE DETECTOR TYPE R161. (DRG 2242/K)

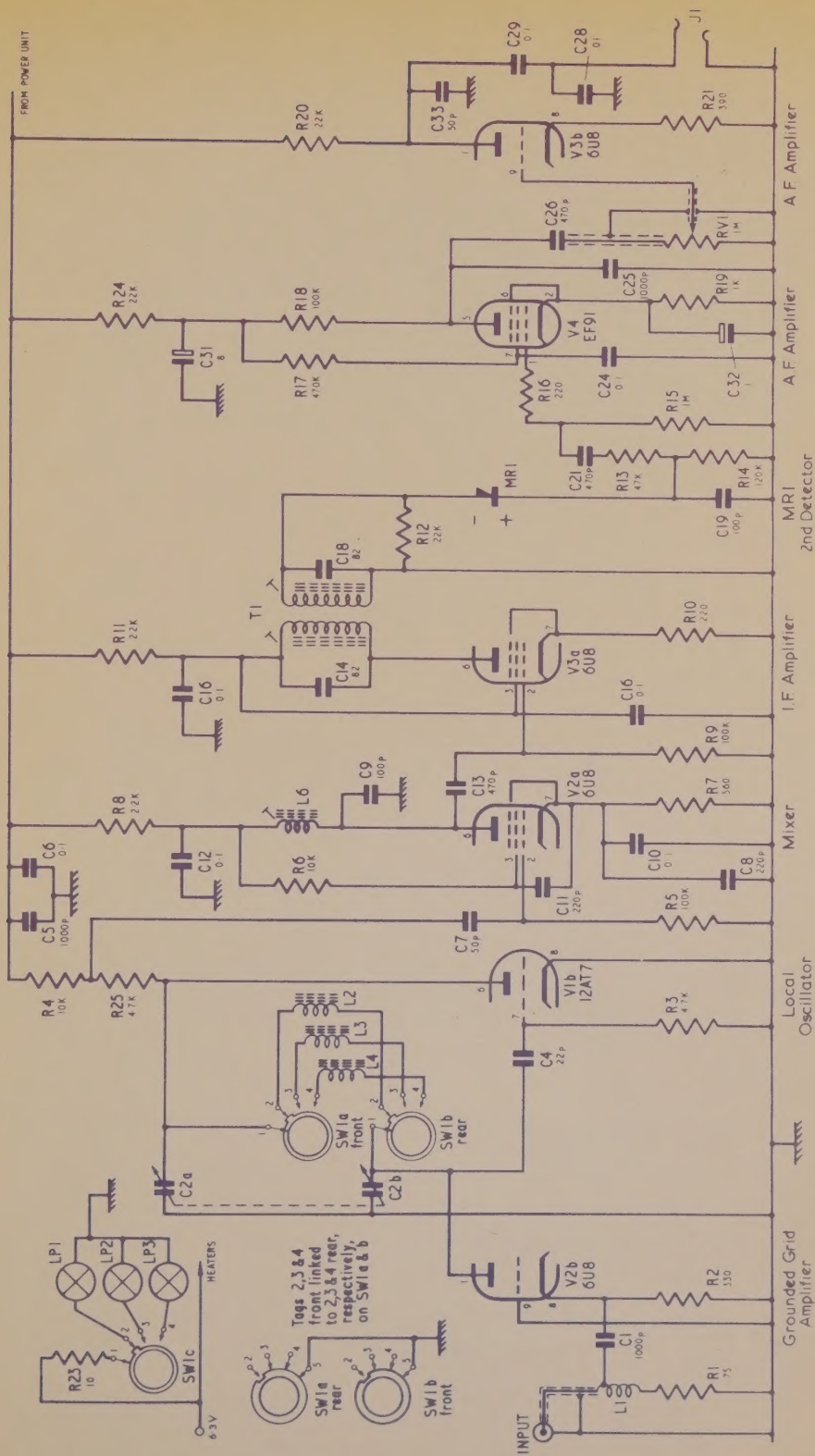


FIG. 4 CIRCUIT OF BRIDGE DETECTOR TYPE R261 (DRG D2200/L)

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